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VARIABILITIES OF CURRENTS UNDER FAST ICE IN LÜTZOW-HOLM BAY, ANTARCTICA—COMPARISON BETWEEN OBSERVATIONS AND MODEL—(ABSTRACT)

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We made current measurements at three sites under fast ice in Lützow-Holm Bay during 1990–1991. In spite of no direct wind forcing and negligible thermohaline forcing, the current velocity is not small. Especially in Ongul Strait, the velocity typically reaches the order of 0.3 m/s. It is also noted that the direction of the mean current changes drastically from southward to northward in May. The currents at all sites have some correlation with the wind, atmospheric pressure and tide at Syowa Station.

We constructed a numerical ocean model to understand the current system under fast ice. We modeled Lützow-Holm Bay and the continental shelf which extends eastward. The model is barotropic, and the westward wind stress is applied to the ocean. In the case of no fast ice on the east shelf (corresponding to the before-May case), mainly the first mode of shelf wave is excited; while, when the margin of the fast ice is located at the shelf break (corresponding to the after-May case), the second mode of shelf wave is preferentially excited. Correspondingly, the current direction near the coast becomes opposite between these cases, which agrees with the observations in Ongul Strait. These studies suggest that the current variability under fast ice is mostly governed by shelf wave (or coastally trapped waves) generated by the wind stress offshore, and the dominant mode of shelf wave depends strongly on the location of the fast ice margin.

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